MEMS and Matlab Metrology

MetroloGT for Matlab – Joe Ceremuga

MetroloGT++ – Austin Chen

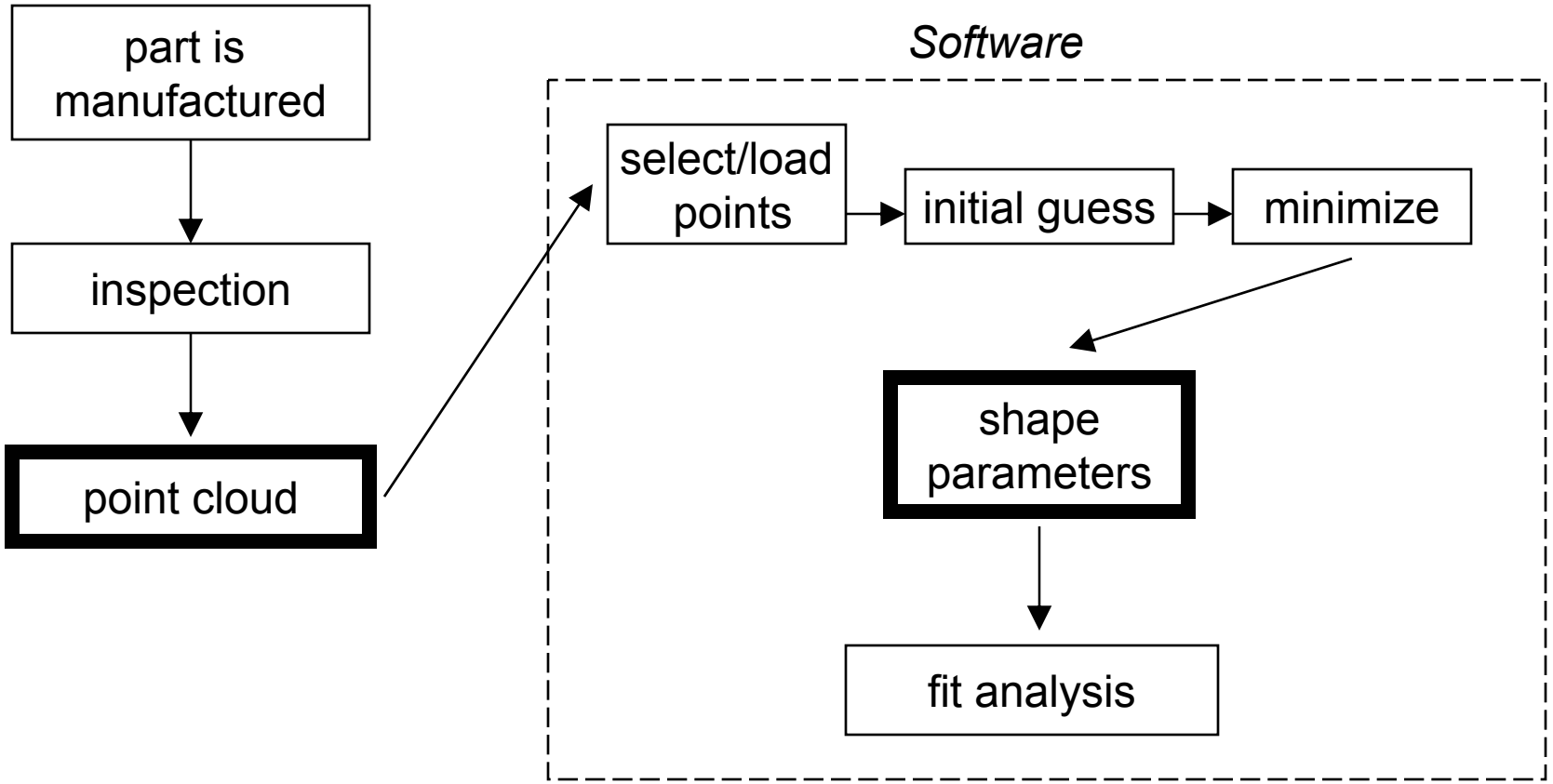
2-D Edge Inspection with Matlab – Meghan Shilling

MetroloGT Toolbox for Matlab

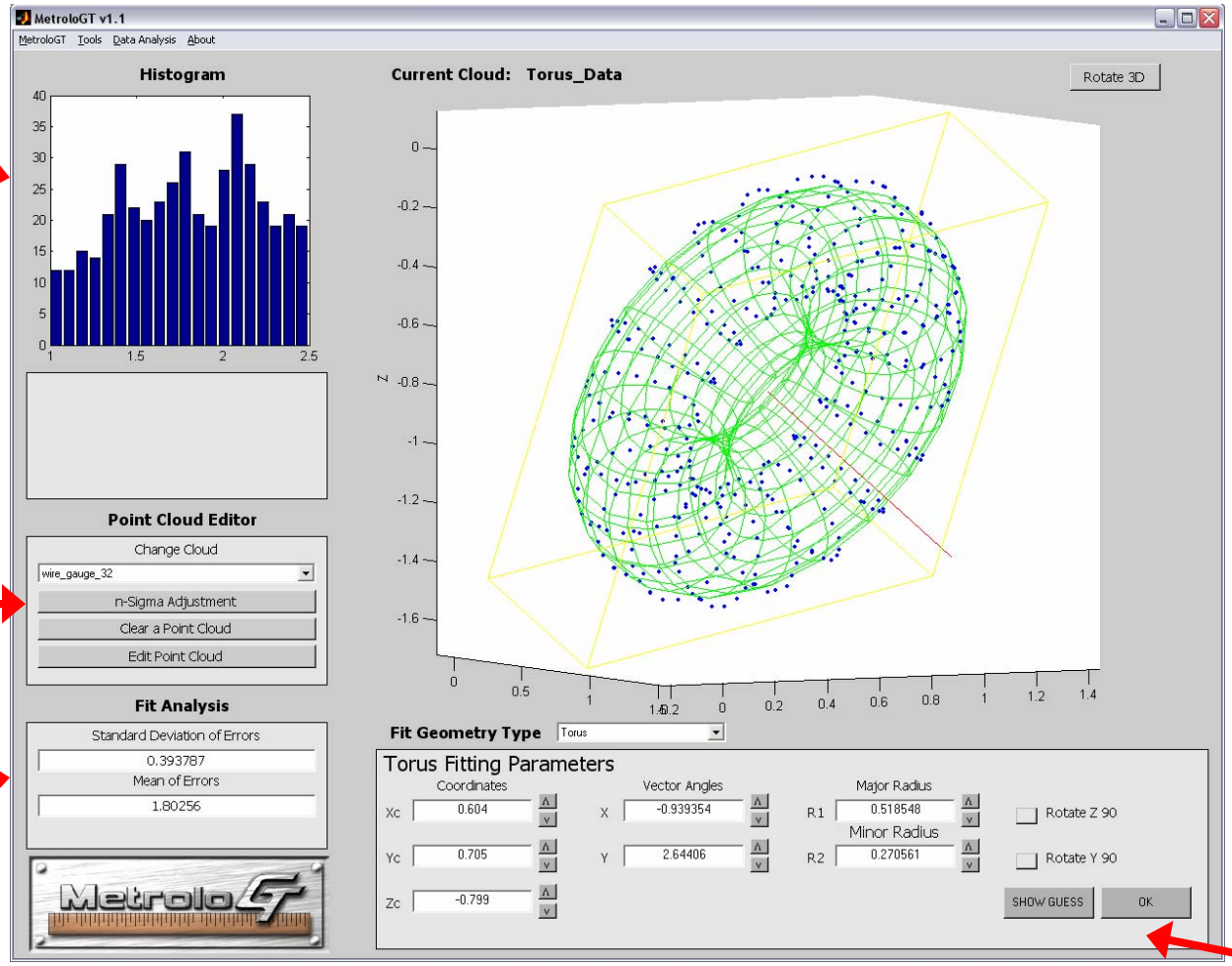
Purpose

- Input 2-D and 3-D coordinate point clouds
- Allow the user to manipulate the point cloud
- Fit primitive shapes to the data
- Analyze fit and then refine the data for further fitting

Procedure


part is manufactured
inspection
point cloud
Software
select/load points
initial guess
minimize
shape parameters
fit analysis

Software Layout



Post-Process Window

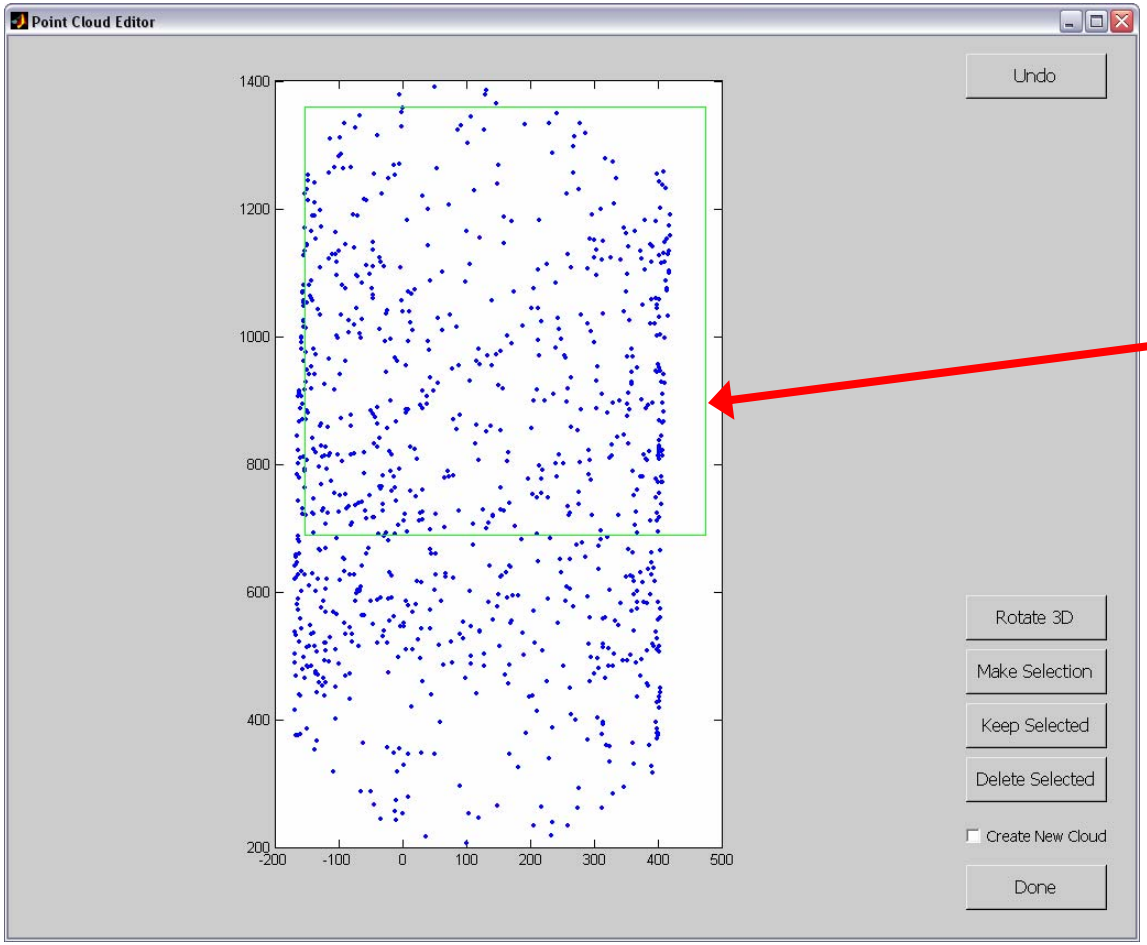
Point Cloud Editor

Fit Results

Fit Parameters and Options

Features

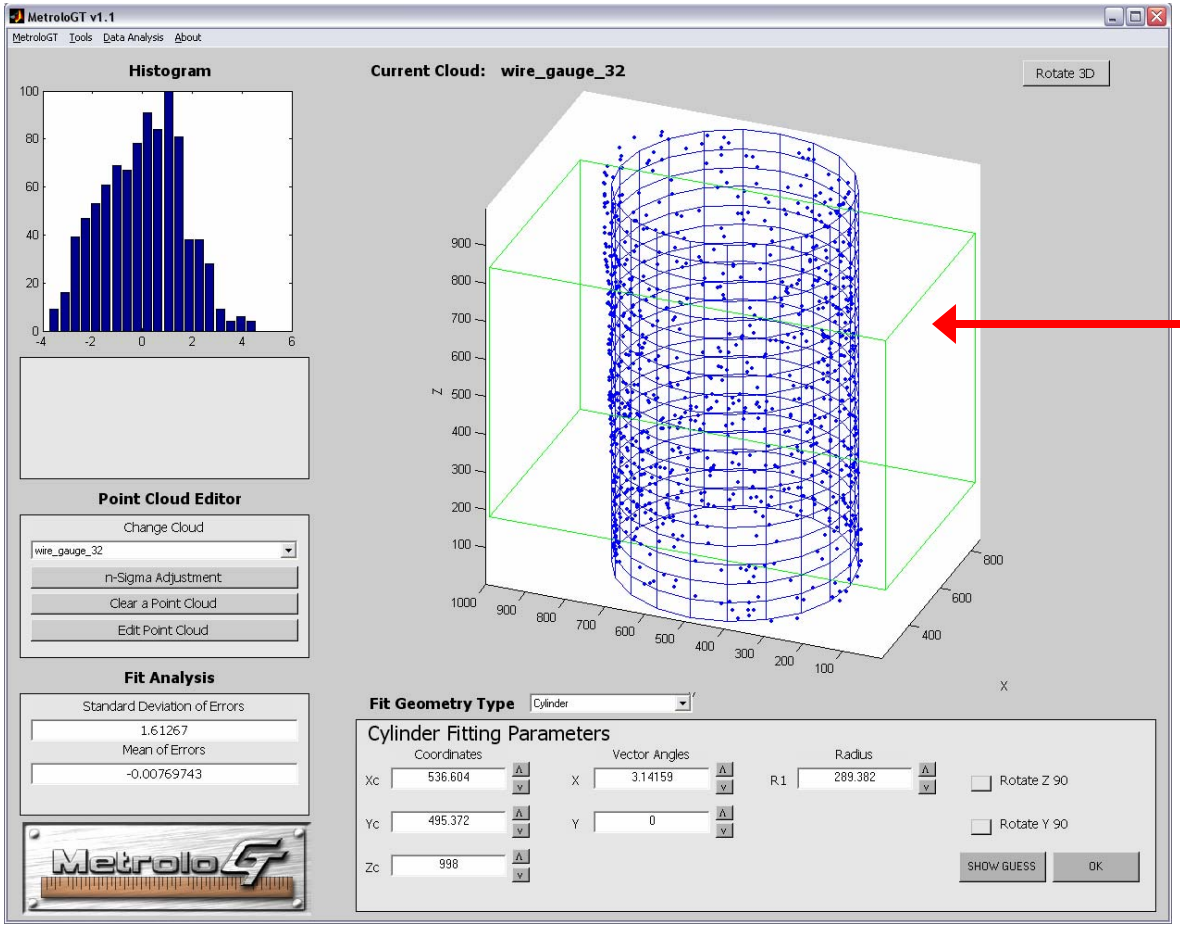
- Point Cloud Editor



Selection Box

Features

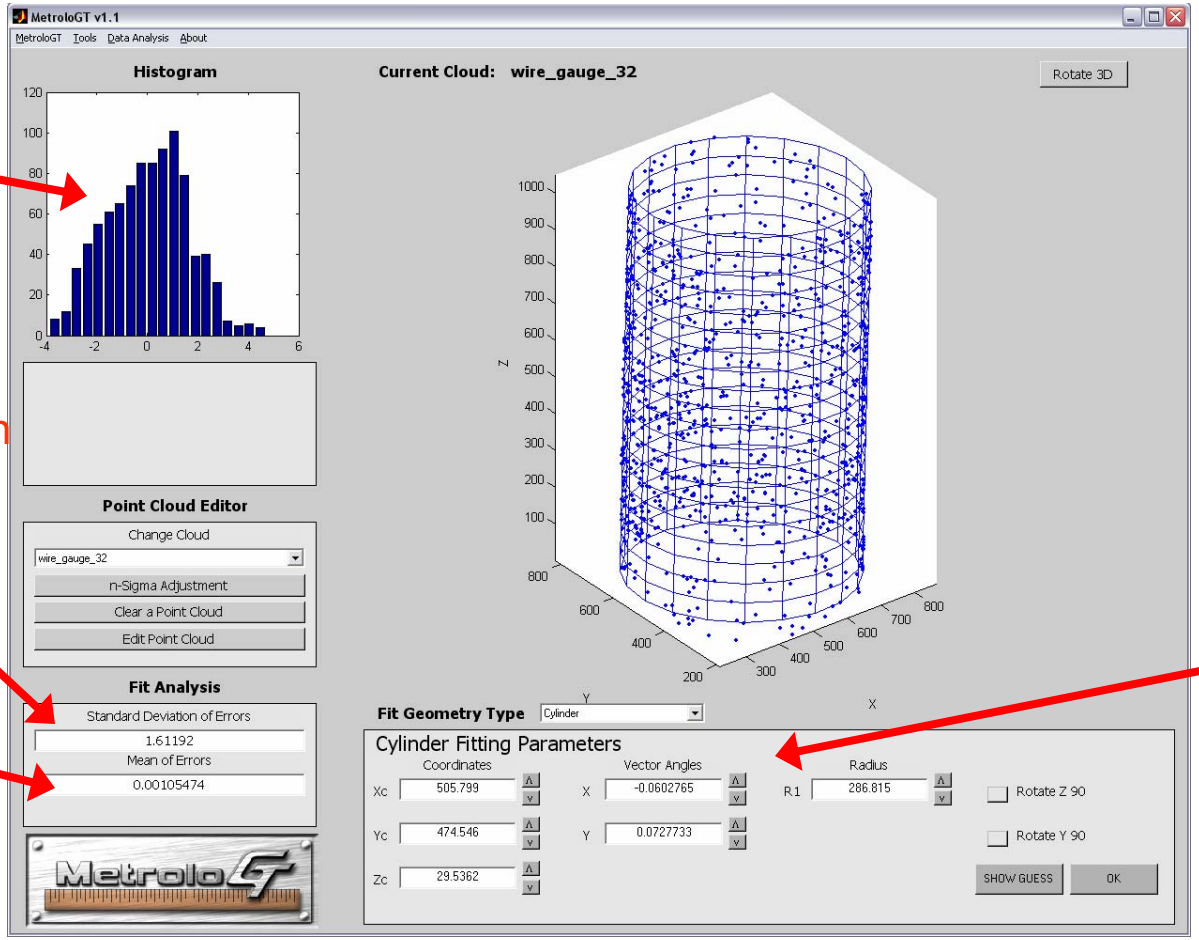
- Initial Guessing (Bounding box)



Bounding Box

Features

- Fit Analysis



Histogram

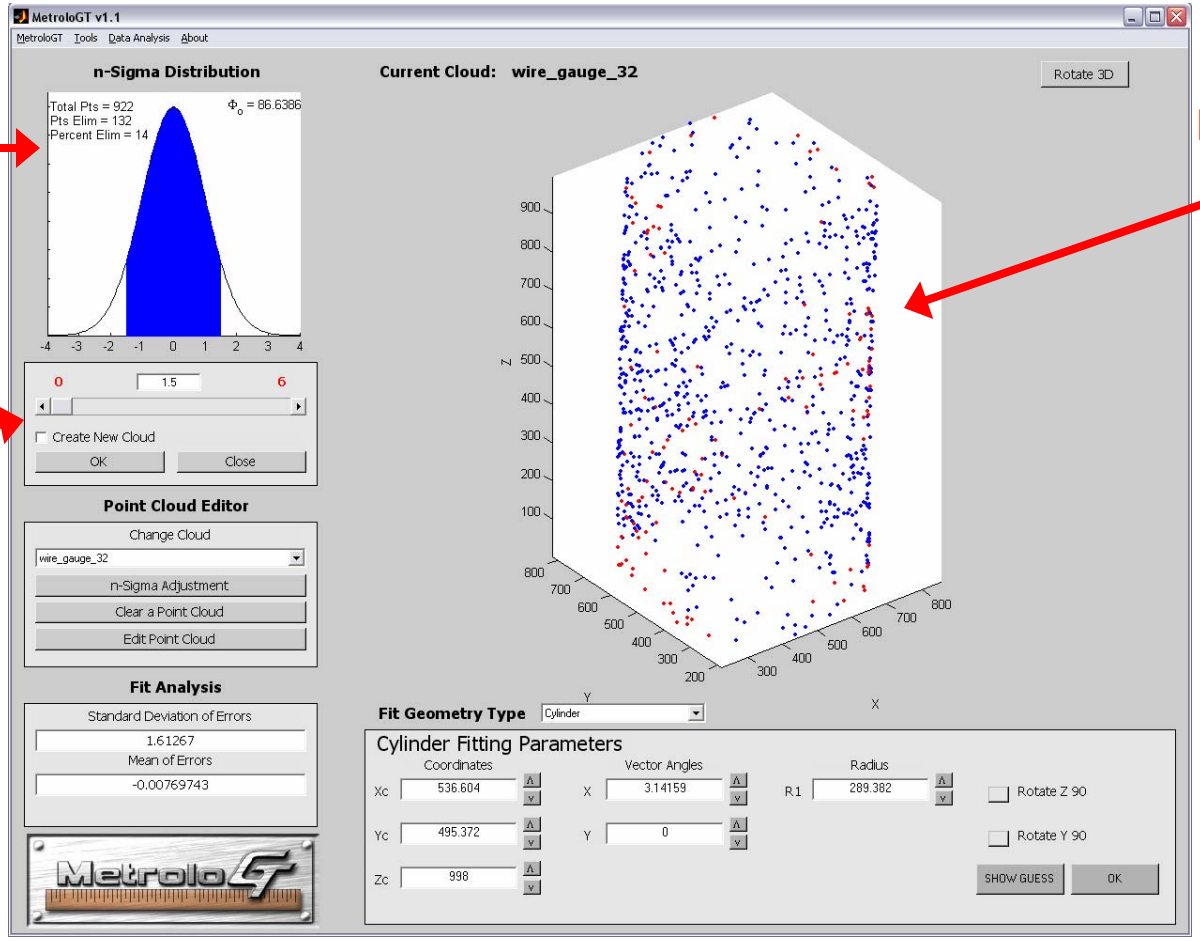
Standard Deviation of Errors

Mean of Errors

Optimized Fit Parameters

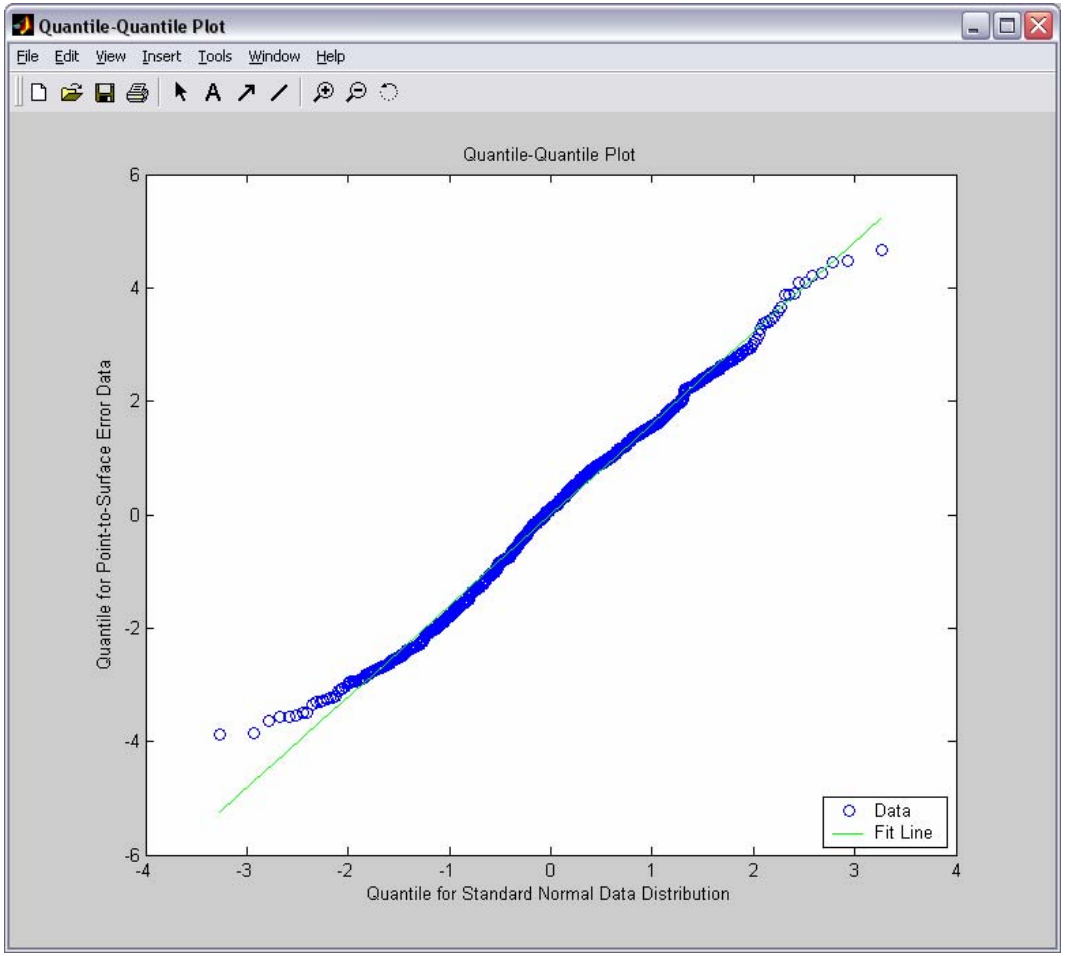
Features

- N-Sigma elimination



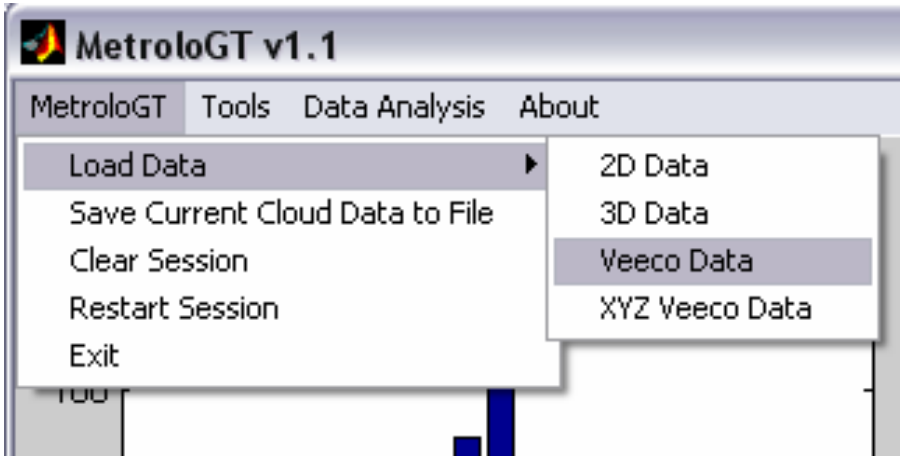
Features

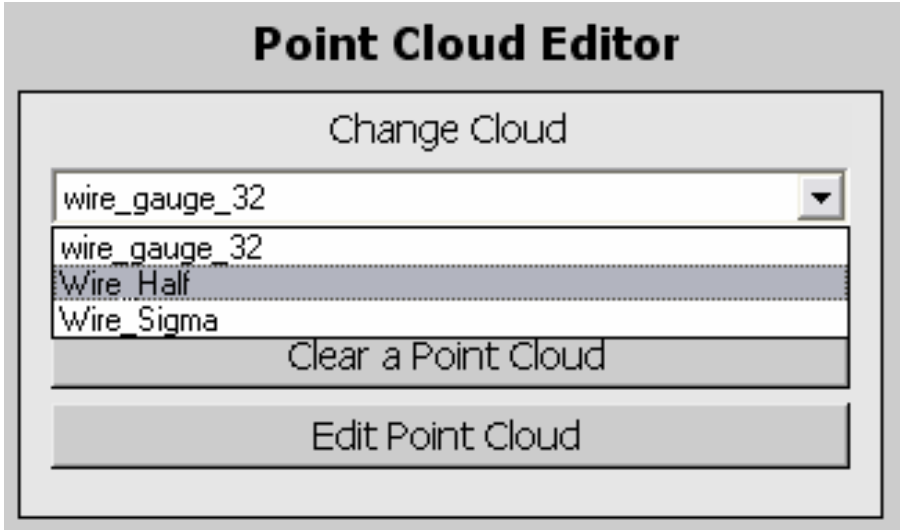
- Quantile-Quantile (QQ) Plotting



Features

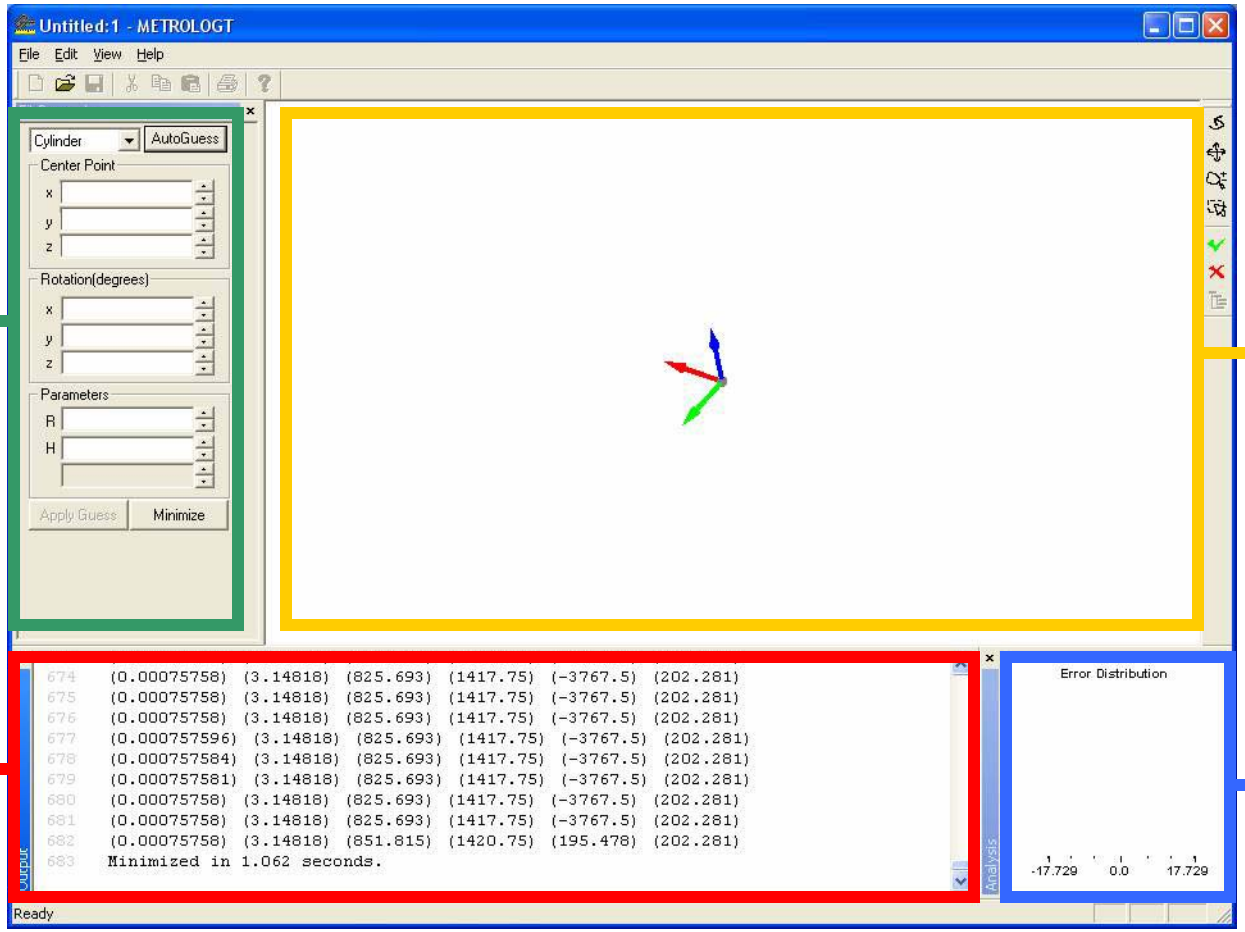
- Cloud options
  - Multiple clouds per session
    - Load (2-D, 3-D, Veeco ™ format)
    - Create (Editor and N-Sigma)
    - Erase
    - Save





MetroloGT++

MetroloGT++



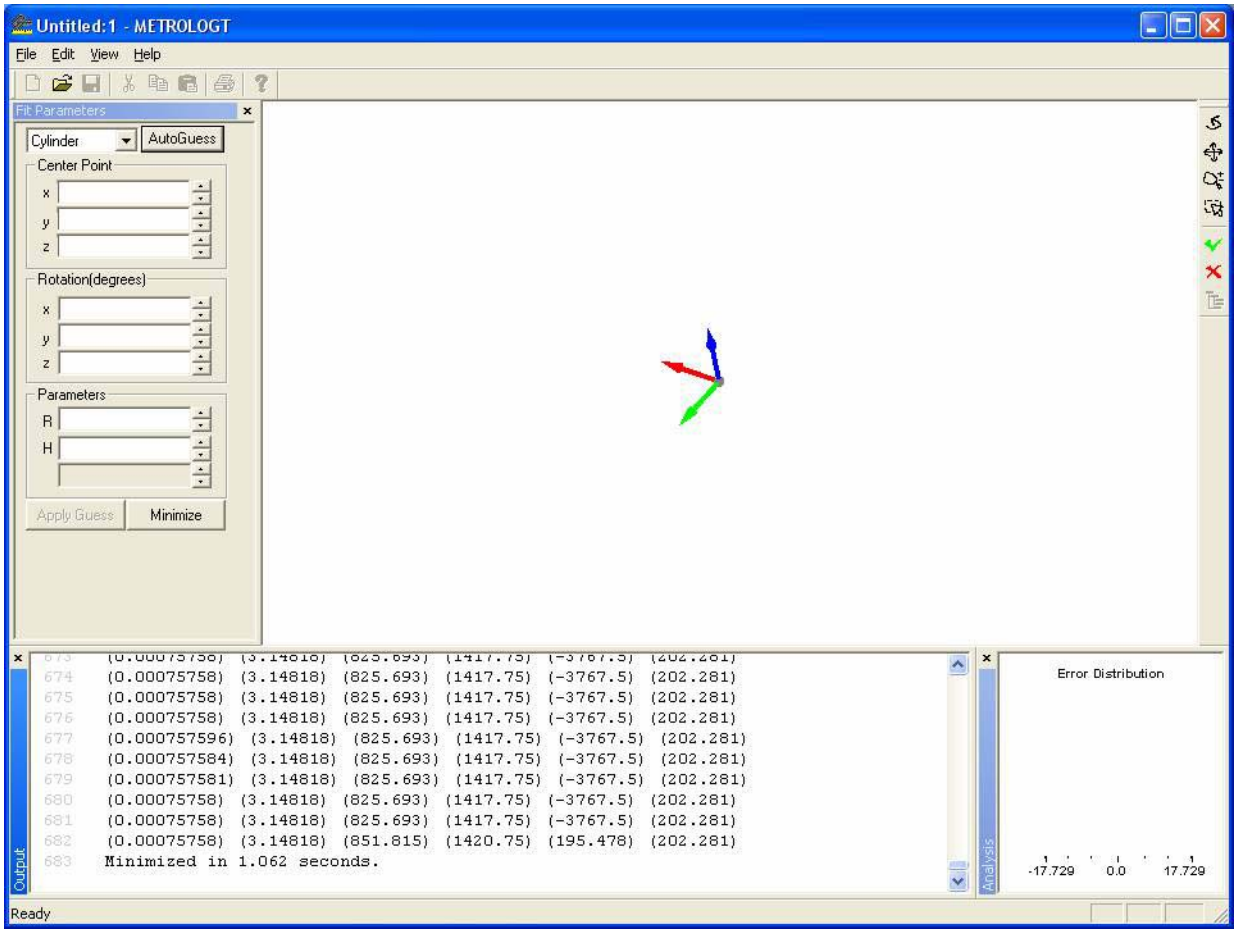
shape parameters

visualization window

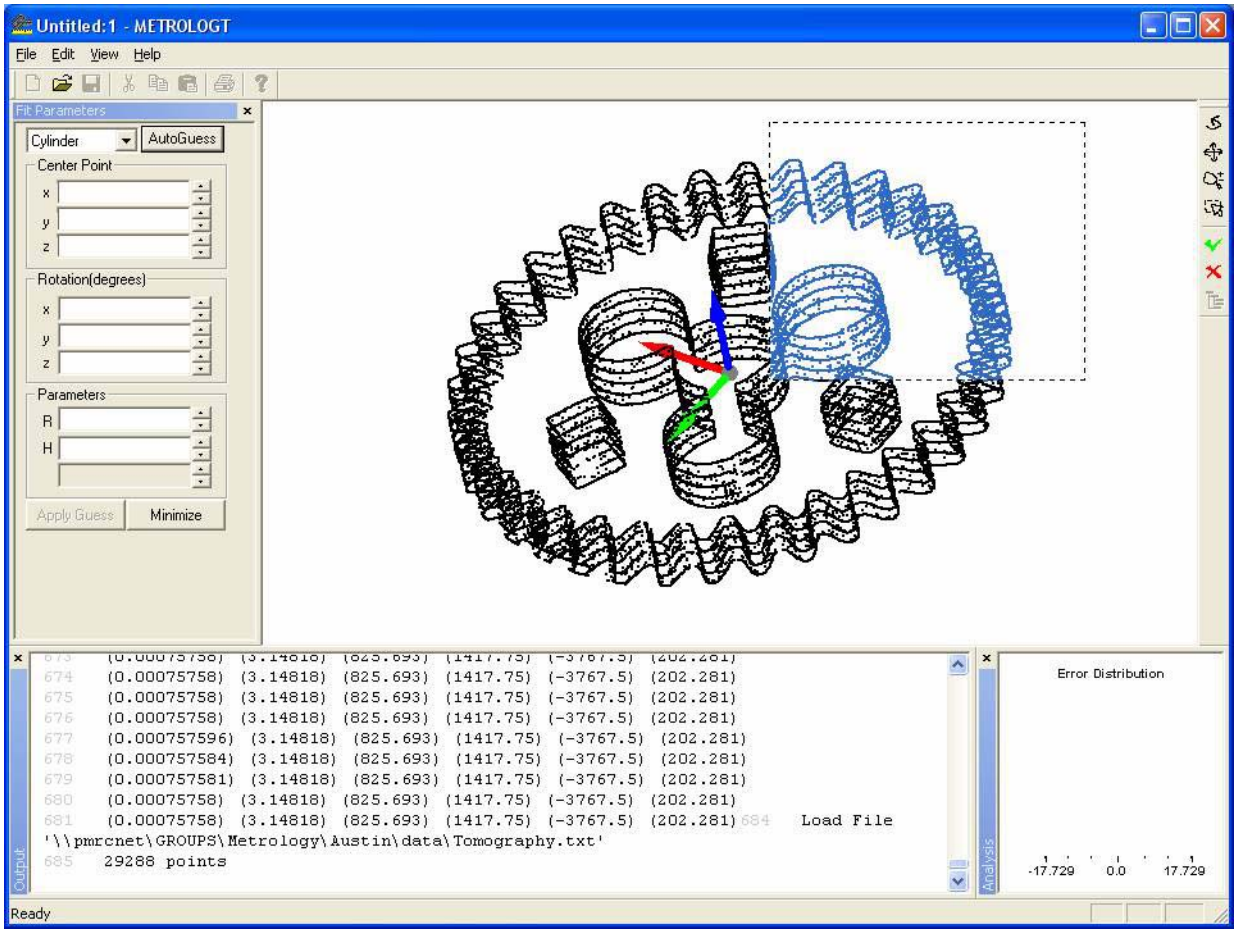
output window

histogram

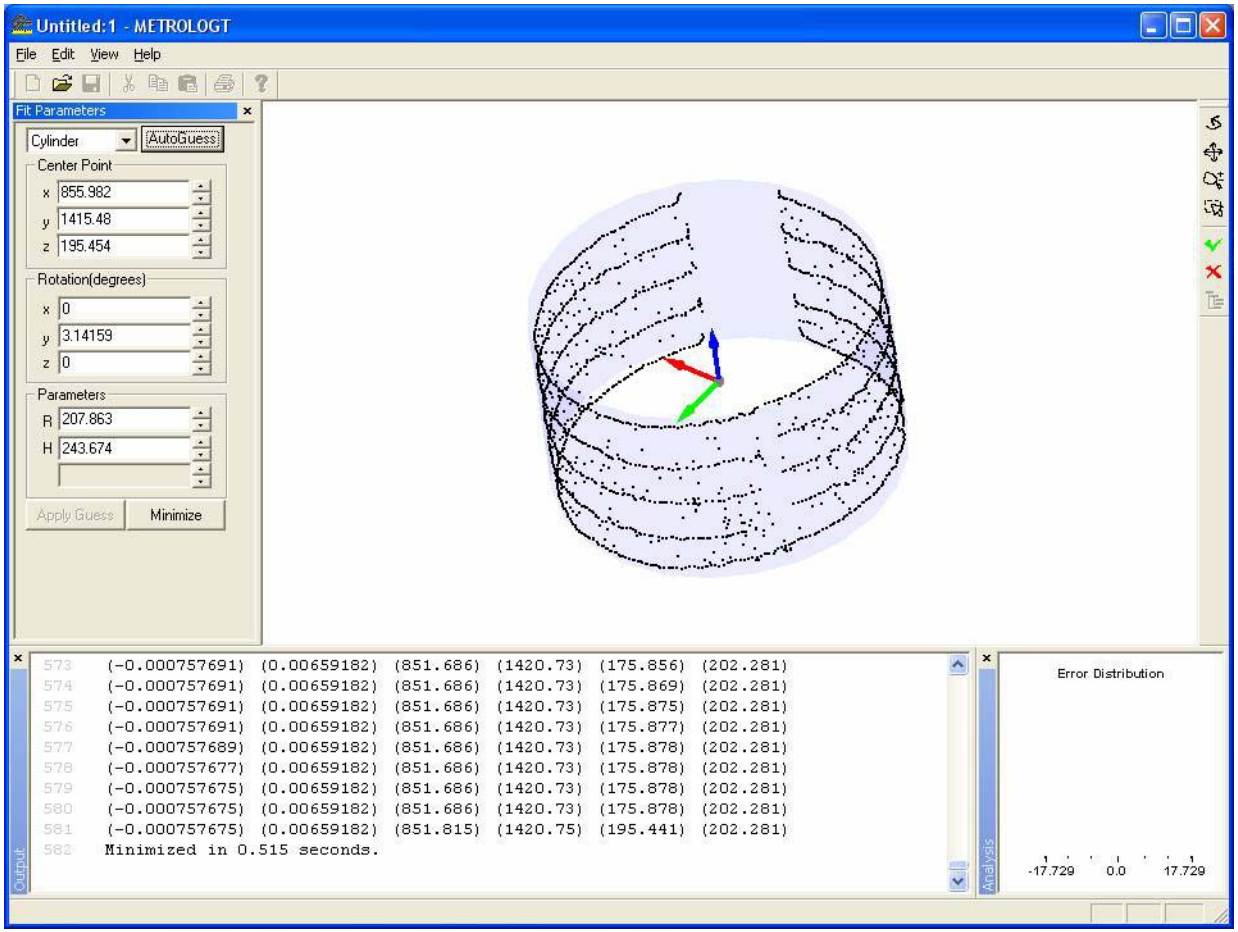
1) start


Untitled:1 - METROLOGT
File Edit View Help
Fit Parameters
Cylinder
AutoGuess
Center Point
x
y
z
Rotation(degrees)
x
y
z
Parameters
R
H
Apply Guess
Minimize
674 (0.00075758) (3.14818) (825.693) (1417.75) (-3767.5) (202.281)
675 (0.00075758) (3.14818) (825.693) (1417.75) (-3767.5) (202.281)
676 (0.00075758) (3.14818) (825.693) (1417.75) (-3767.5) (202.281)
677 (0.000757596) (3.14818) (825.693) (1417.75) (-3767.5) (202.281)
678 (0.000757584) (3.14818) (825.693) (1417.75) (-3767.5) (202.281)
679 (0.000757581) (3.14818) (825.693) (1417.75) (-3767.5) (202.281)
680 (0.00075758) (3.14818) (825.693) (1417.75) (-3767.5) (202.281)
681 (0.00075758) (3.14818) (825.693) (1417.75) (-3767.5) (202.281)
682 (0.00075758) (3.14818) (851.815) (1420.75) (195.478) (202.281)
683 Minimized in 1.062 seconds.
Output
Error Distribution
-17.729
0.0
17.729
Analysis
Ready

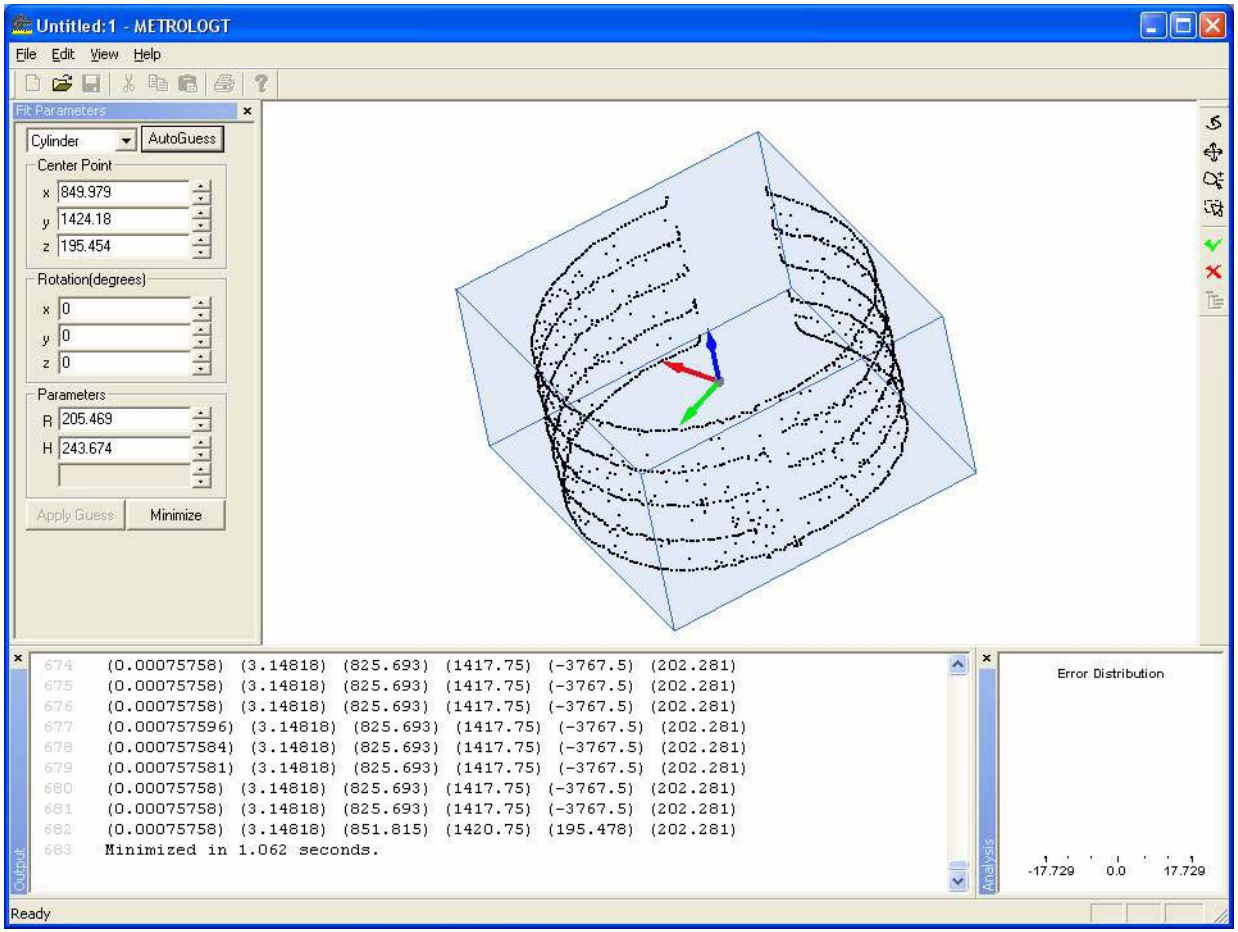
2) load and select points



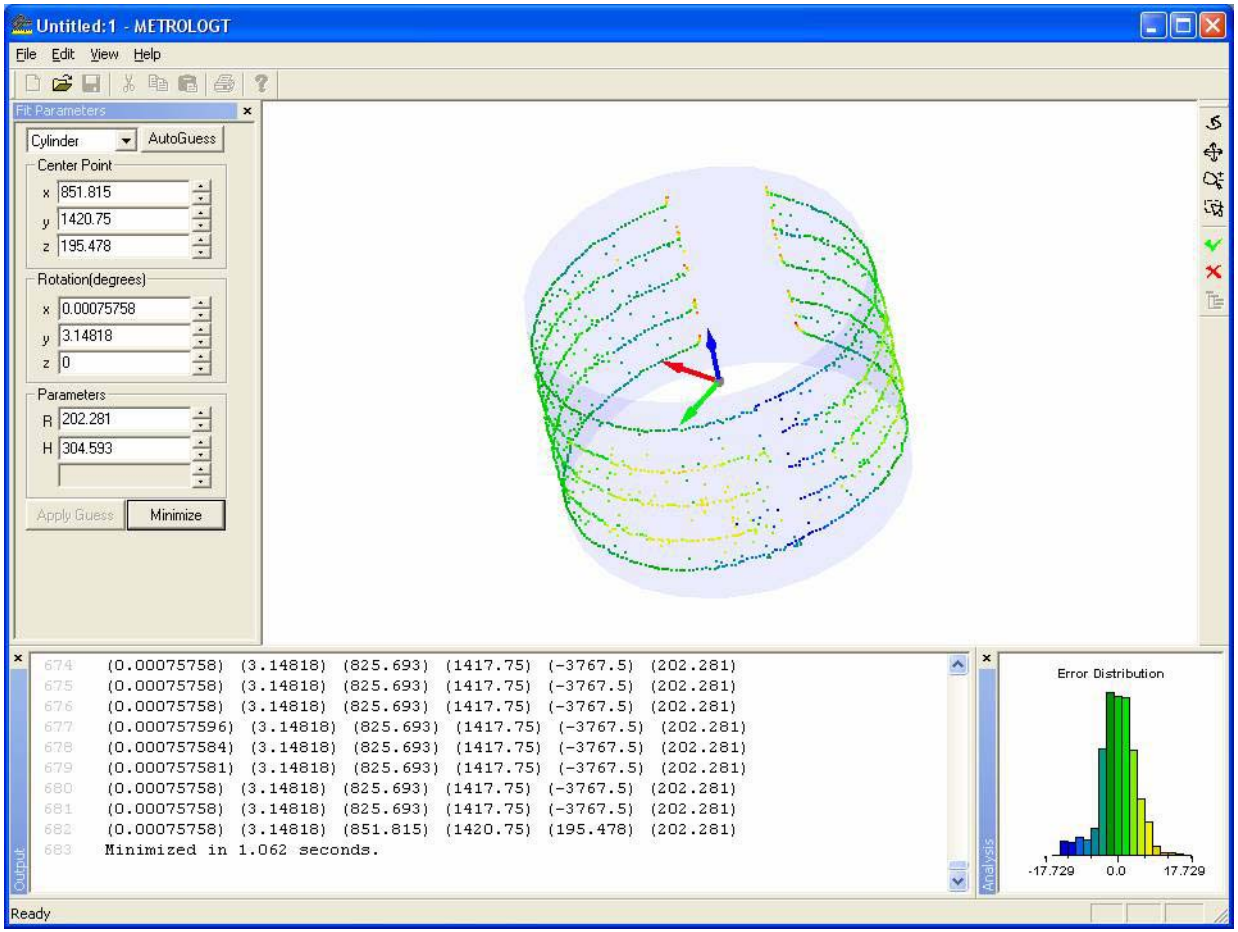
3a) initial guess



3b) minimum bounding box (hidden)



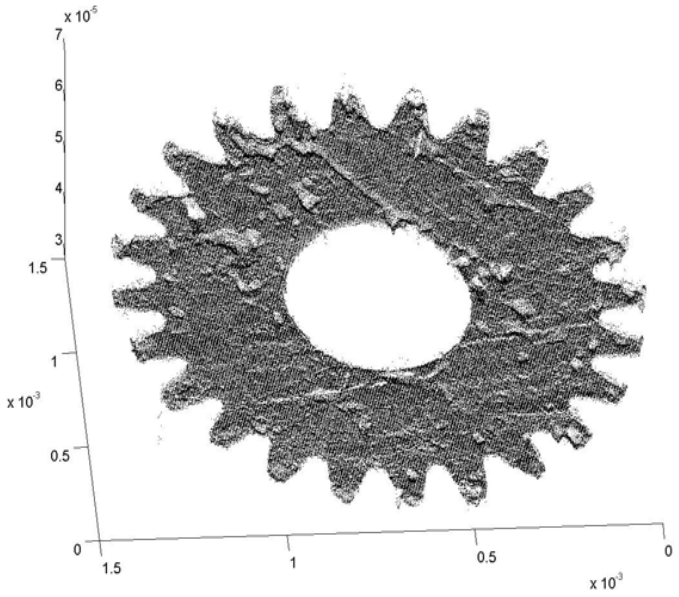
4) fit primitive



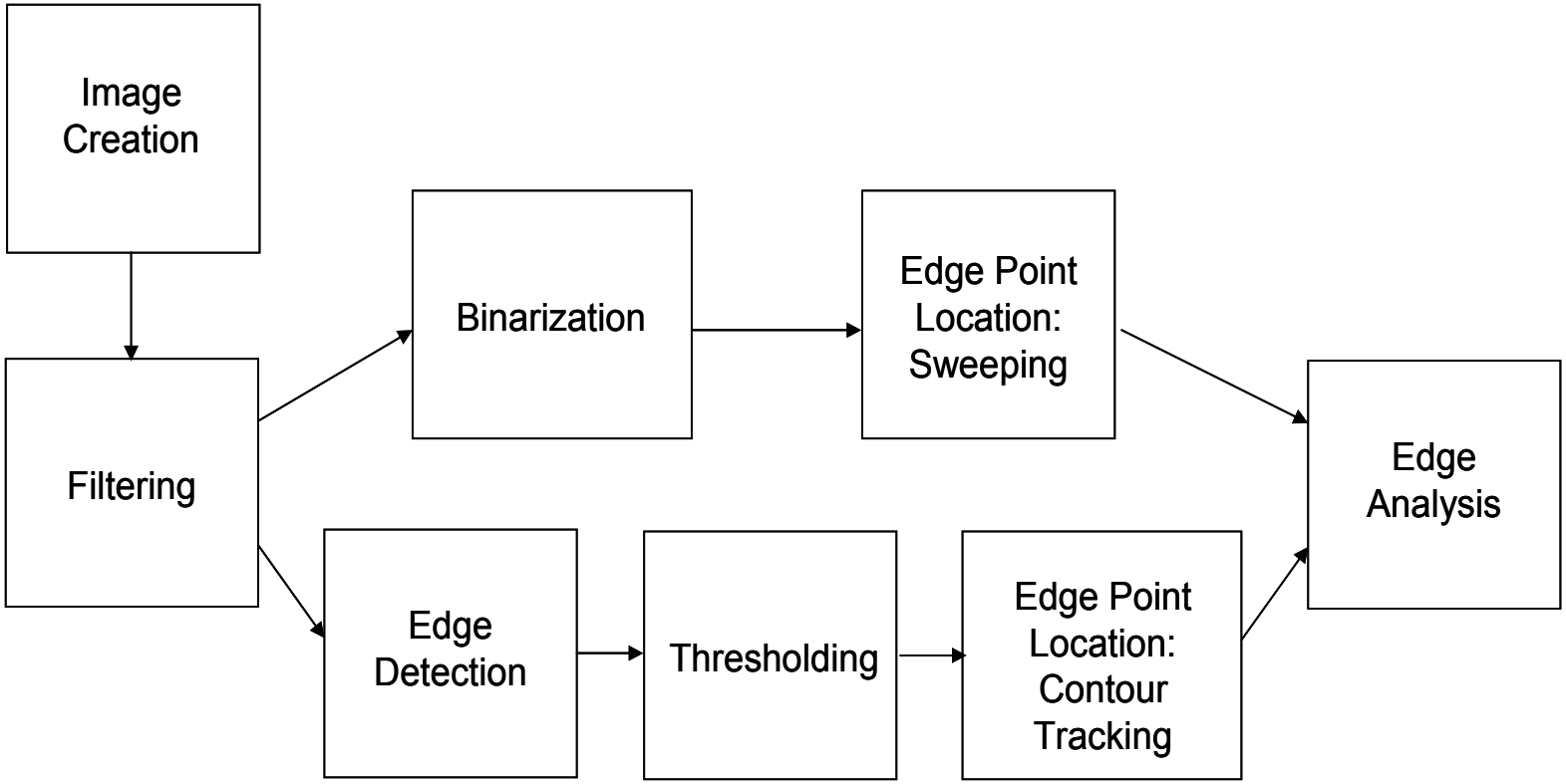
2-D Edge Detection

Two Dimensional Analysis

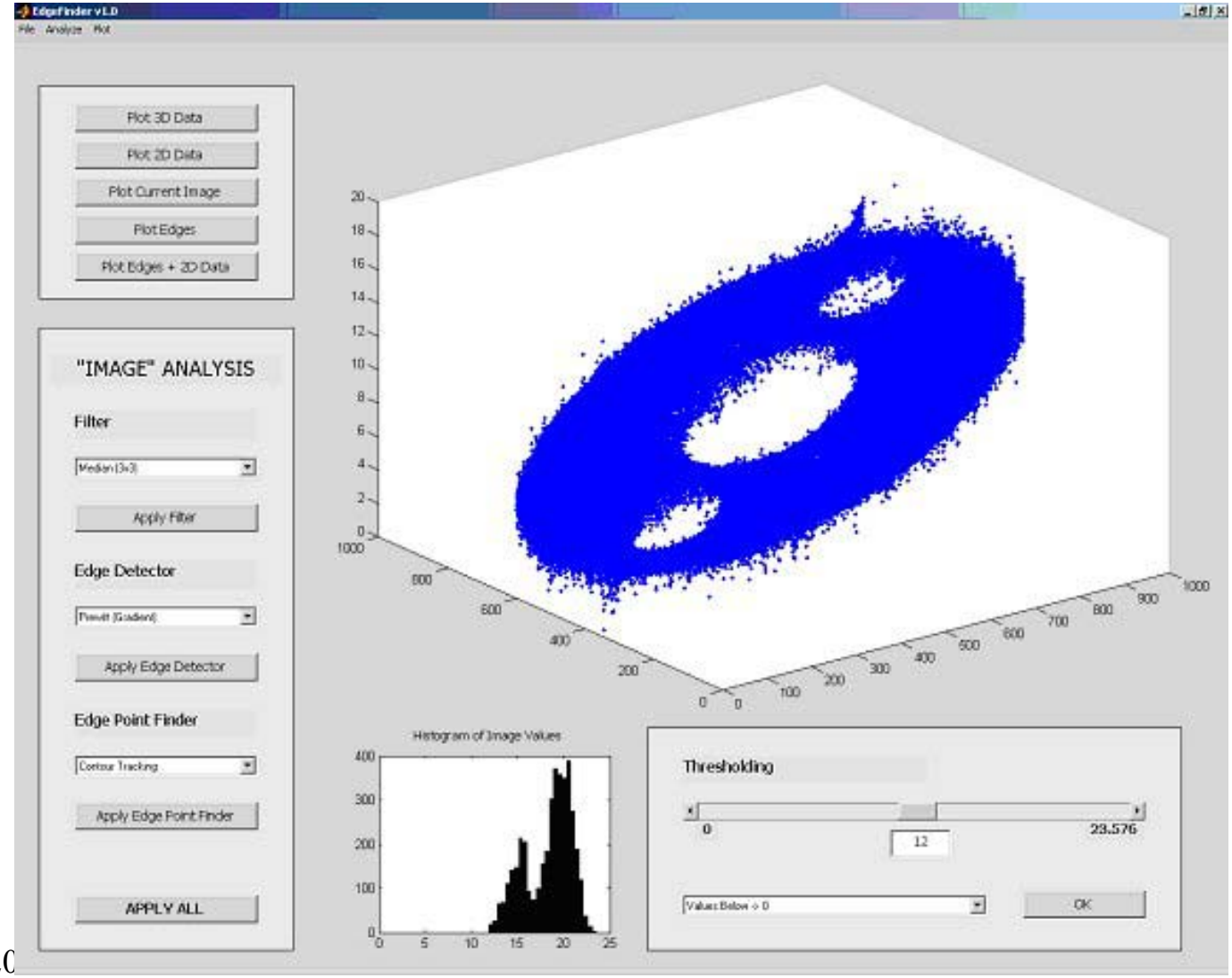
- Fit two dimensional data to lines, circles and ellipses
- If data was taken from the surface of an object, edges need to be found



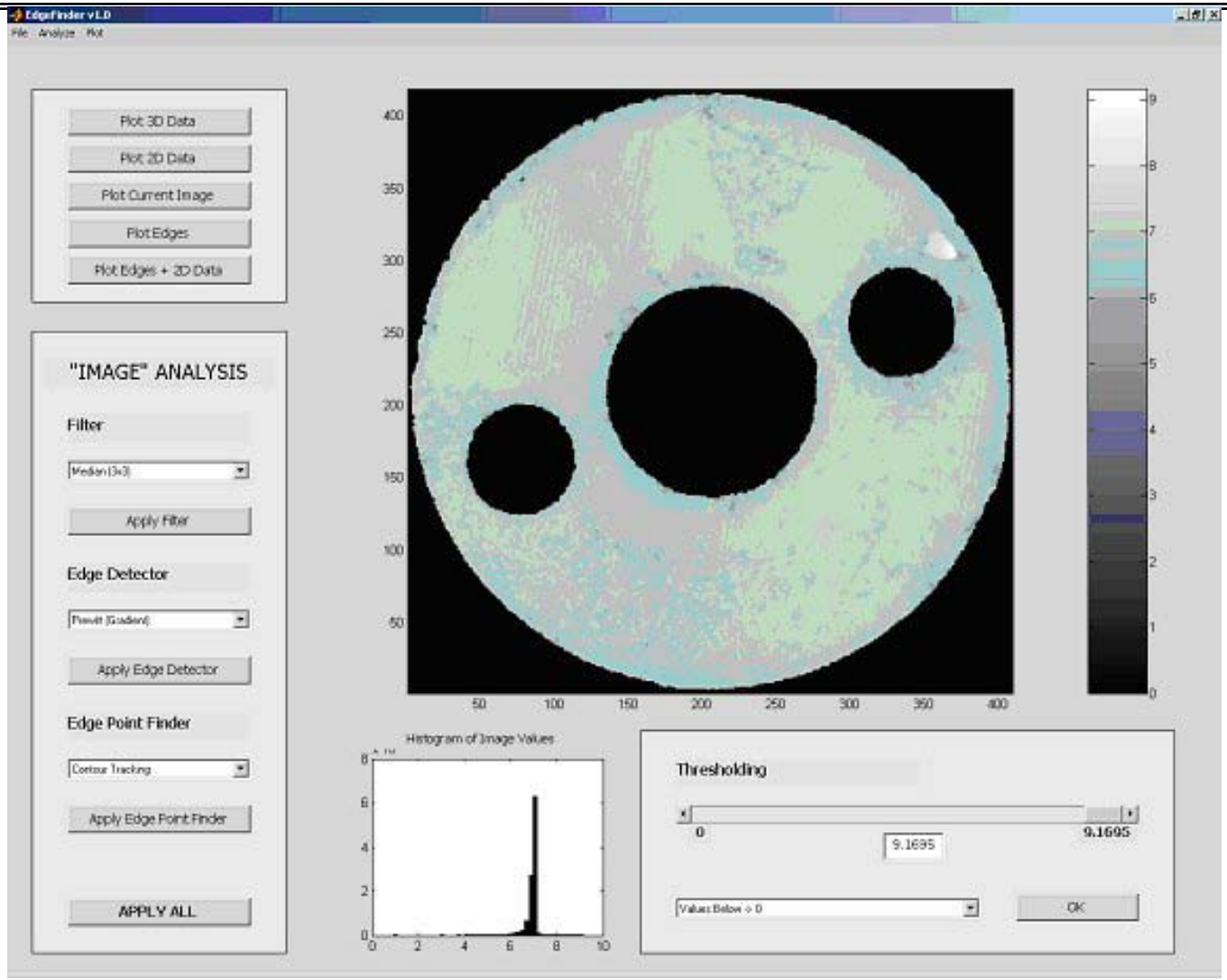
Edge Location



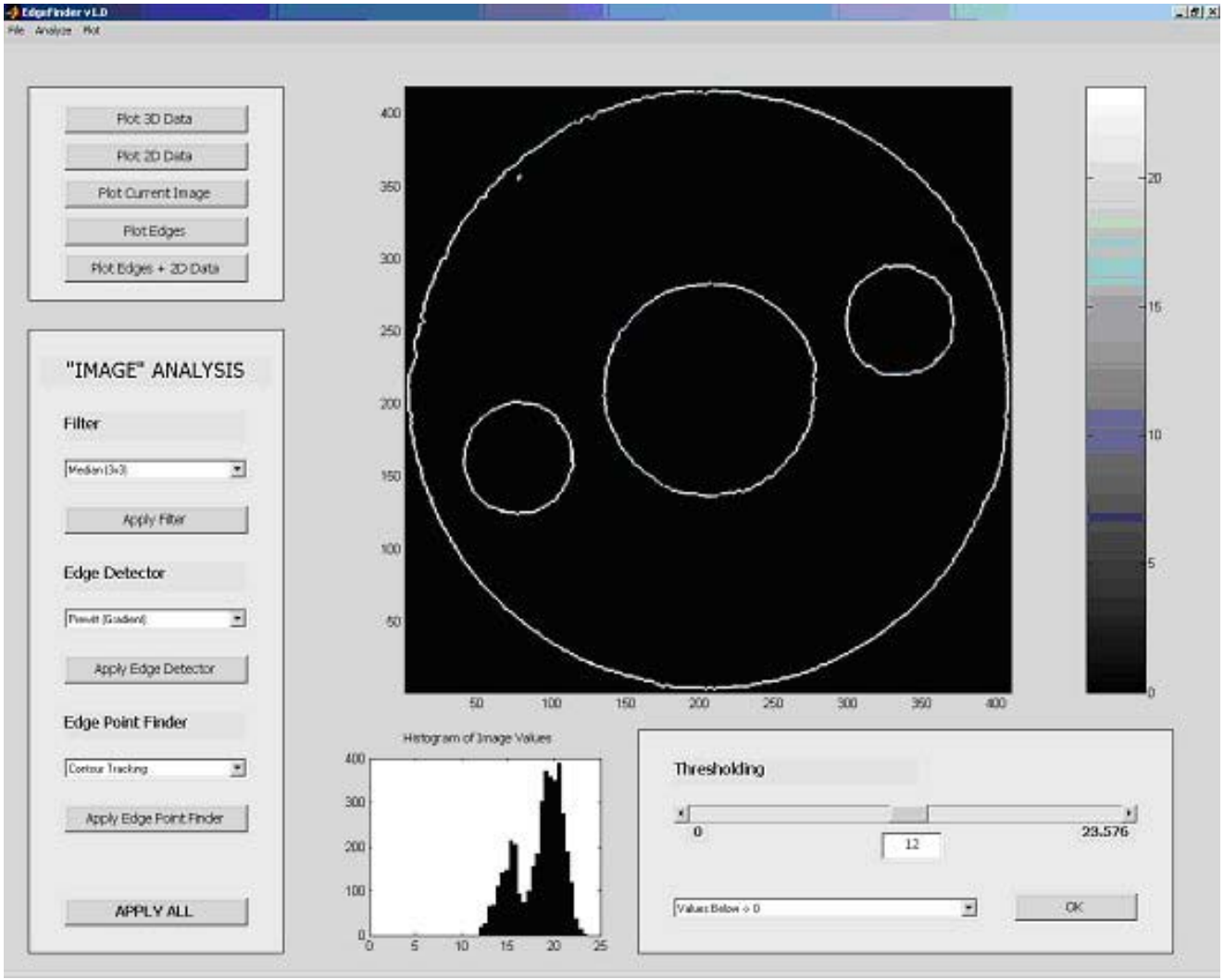
Initial Point Cloud



Filtered Image



Edges from Edge Detector



Resulting Edge Points